FEASIBILITY STUDY
FOR THE
LAKE ENHANCEMENT PROGRAM
OF
PRIDES CREEK LAKE
NEAR
PETERSBURG, INDIANA

Prepared for:

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EXECUTIVE SUMMARY

A lake enhancement study of Prides Creek Lake near Petersburg, Indiana in Pike County was made to evaluate the existing conditions plaguing the lake's full utilization. Field and laboratory data indicated that sediment deposition and excessive aquatic vegetation were the major problems endangering the lake. The preferred alternative to remedy these problems is Alternative No. 2. This alternative proposes the construction of two inlet sediment control structures, physical and chemical aquatic weed control, and the removal of some lake sedimentation. The capital cost of this alternative under the "T by 2000" Lake Enhancement Program is estimated at $150,000 with an annual maintenance cost of $3,000. Implementation of erosion control measures in the upstream watershed could be funded by the "T by 2000" Land Treatment Program.

INTRODUCTION

Prides Creek Lake is a ninety (90) acre multi-purpose impoundment located near Petersburg, Indiana. The lake is located entirely within Prides Creek Park which is a public recreation facility administered by the Prides Creek Conservancy District. The Park provides shore fishing as well as a concrete boat ramp providing angler access, public beach and swimming area, and camping facilities.

The Lake Enhancement Study was to evaluate existing conditions plaguing Prides Creek Lake. The specific areas of concern were sedimentation of the inlets, the aquatic weed problem which is affecting shore fishing and boat launch area, and nutrient loading. The study encompasses these concerns and presents our findings, conclusions and recommendations.

EXISTING CONDITIONS

To evaluate the existing conditions, field reconnaissance and sampling trips were made on April 20, July 20-21, and August 3, 1988. During these trips, water quality and lake sedimentation data were collected. An aquatic weed and algal survey was conducted on August 3, 1988. In the following sections, the existing conditions determined from these findings are presented.

Water Quality

The major source of the water contained by the man-made 90-acre lake is surface runoff. The water sampling sites used for identifying the existing conditions represented lake influent, effluent, and pool locations. Table 1 and Figure 1 list and identify each sampling site. Each site was evaluated for a specific set of field and laboratory parameters as summarized in Table 2. A summary of the lake laboratory results is presented in Table 3.

At Site PC1, no discharge was observed during the August 3, 1988 visit. The lake pool was approximately six inches below the surface withdrawal overflow spillway outlet. The effluent water quality expected from the lake would be similar to the near surface pool site PC2 collected near the dam.

The deepest lake site was 27 feet deep and was sampled at PC2 near the dam and spillway. A plot of the field data is shown in Figure 2. The data show gradual decline in temperature as the probe is lowered deeper in the pool. The Secchi disk reading was 10.8 feet. This measurement of light penetration closely correlated to the layer containing the maximum amount of oxygen (10 feet) and the depth at which there was a noticeable change in light transmission (12.5 feet). Noticeable changes in pH and conductivity were also recorded below 12.5 feet. These relationships among the field parameters are typical for second-class lakes like Prides Creek Lake. G. Evelyn Hutchinson (1957) published "A Treatise on Limnology" which reported that second-class lakes have: (1) thermal stratification but with bottom temperature above $4^{o}C$, (2) a rough correspondence between the light transmission and the Secchi disk reading, (3) an inverse variation of light

TABLE 1
MONITORING STATIONS
PRIDES CREEK LAKE

SITE ID	SITE DESCRIPTION	PARAMETER LIST KEY
PC1	Prides Creek Lake - effluent	C
PC2	Prides Creek Lake - pool, near dam	B
PC3	Prides Creek Lake - pool, mid-point	B
PC4	Prides Creek Lake - pool, near confluences of two major tributaries	B
PCS1	Prides Creek Lake - sediment sample in delta below road culvert	D
PCS2	Prides Creek Lake - sediment sample in delta above road culvert	D
PCR1	Prides Creek Lake - storm sample at lake influent	A
PCR2	Prides Creek Lake - storm sample at lake influent	A
PCR3	Prides Creek Lake - storm sample at lake influent	A
PCR4	Prides Creek Lake - storm sample at lake influent	A
PCR5	Prides Creek Lake - storm sample at lake influent	A
PCR6	Prides Creek Lake - storm sample at lake influent	A
PCR7	Prides Creek Lake - storm sample at lake influent	A

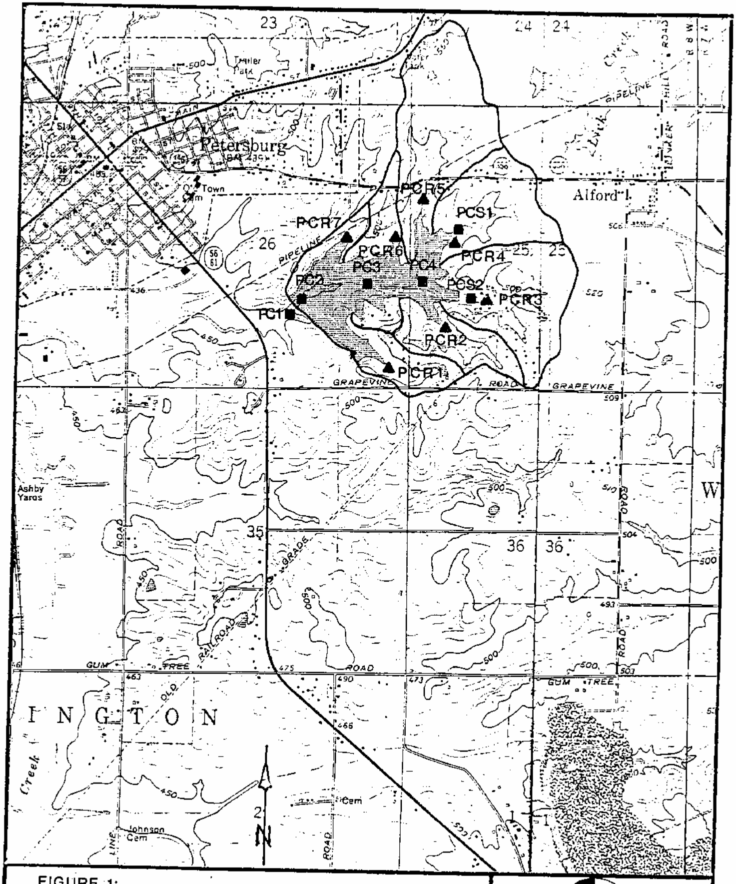

FIGURE 1:

PRIDES CREEK LOCATION MAP

SCALE: 1"–2000'

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TABLE 2

FIELD AND LABORATORY PARAMETER LIST
PRIDES CREEK LAKE

A LAKE INFLUENT	B LAKE POOL	C LAKE EFFLUENT
Field:	**Field:** (in situ every 5 ft.)	**Field:**
Temperature	Temperature	Temperature
Dissolved Oxygen	Dissolved Oxygen	Dissolved Oxygen
pH	pH	pH
Specific Conductance	Specific Conductance	Specific Conductance
Discharge	Light Transmission	Discharge
	Secchi Disk Reading	
	Depth Reading	
Laboratory:	**Laboratory:**	**Laboratory:**
Total Phosphorus	Total Phosphorus	Total Phosphorus
Dissolved Phosphorus	Dissolved Phosphorus	Dissolved Phosphorus
TKN	TKN	TKN
Nitrate	Nitrate	Nitrate
Ammonia	Ammonia	Ammonia
Total Suspended Solids		
Fecal Coliform		

D
SEDIMENT CORES

Laboratory:

- Total Phosphorus
- Dissolved Phosphorus
- TKN
- Nitrate
- Ammonia

TABLE 3

LABORATORY TEST RESULTS
PRIDES CREEK LAKE
AUGUST 3, 1988

SITE	DEPTH (ft)	TSS (mg/L)	NO_3-N (mg/L)	NH_3-N (mg/L)	TKN (mg/L)	P^T (mg/L)	P^D (mg/L)
PC1	No discharge						
PC2	0	14	<0.05	0.06	0.65	0.03	<0.01
	15	6	<0.05	0.30	2.10	0.06	<0.01
	25	8	<0.05	1.24	1.35	0.10	<0.01
PC3	Composite	1	<0.05	0.09	0.88	0.05	<0.01
PC4	Composite	1	<0.05	0.10	0.88	0.04	<0.01

TSS - Total Suspended Solids

NO_3-N - Nitrate as Nitrogen

NH_3-N - Ammonia as Nitrogen

TKN - Total Kjeldahl Nitrogen

P^T - Total Phosphorus

P^D - Dissolved Phosphorus

- -

$TN = TKN + NO_2 + NO_3$

$TKN = NH_3\text{-}N + \text{Organic } N$

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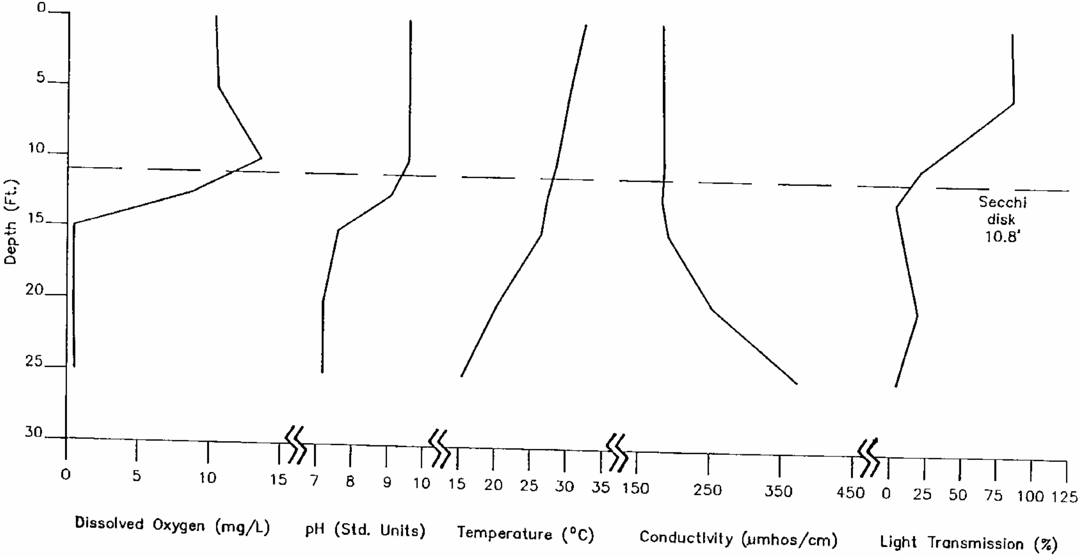
FIGURE 2.

PRIDE CREEK LAKE
SITE PC2
August 3, 1988



transmission and phytoplankton density, and (4) oxygen deficits below the thermocline where the oxidation of organic matter occurs and where additional oxygen is not being produced by photosynthesis. The laboratory results indicated limiting concentrations of nitrogen and phosphorus. Investigators have established that when inorganic nitrogen content is greater than 0.3 mg/L N and orthophosphate content exceeds 0.01 mg/L, the lake is likely to have excessive crops of algae and other aquatic plants. The Prides Creek Lake 0 and 15-foot samples had nitrate concentrations <0.05 mg/L as N and the dissolved phosphate was <0.01 mg/L as P. These concentrations suggest limiting conditions.

Site PC3 was located near the mid-point of the lake pool at a depth of 21 feet. The Secchi disk reading was 10.6 feet and noticeable changes in light transmission and dissolved oxygen also occurred near that depth shown in Figure 3 as in Site PC2. pH, temperature, and conductivity changes were less noticeable. Composite sample analysis of this site showed a similar water quality to PC2. A low concentration of inorganic nitrogen (0.09 mg/L) and undetectable concentrations of dissolved phosphorus (<0.01 mg/L) were recorded.

At PC4, the field parameters shown in Figure 4 were very similar to PC3. The Secchi disk reading was 10.6 feet and characteristic changes in dissolved oxygen and light transmission occurred near that depth. Changes in pH, conductivity, and temperature were also recorded. The low concentrations of plant limiting nutrients (nitrogen and

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FIGURE 3.

PRIDE CREEK LAKE
SITE PC3
August 3, 1988

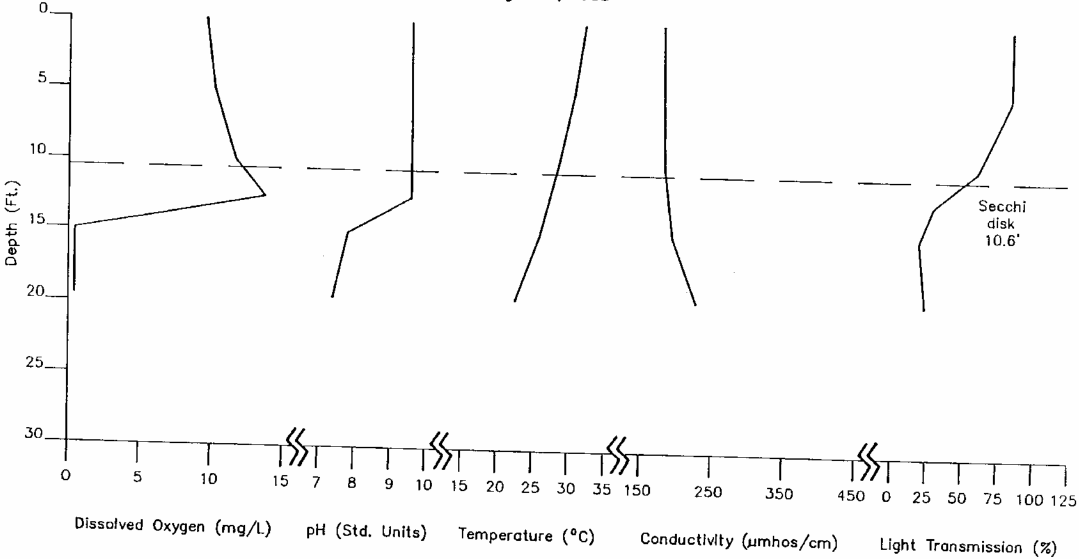

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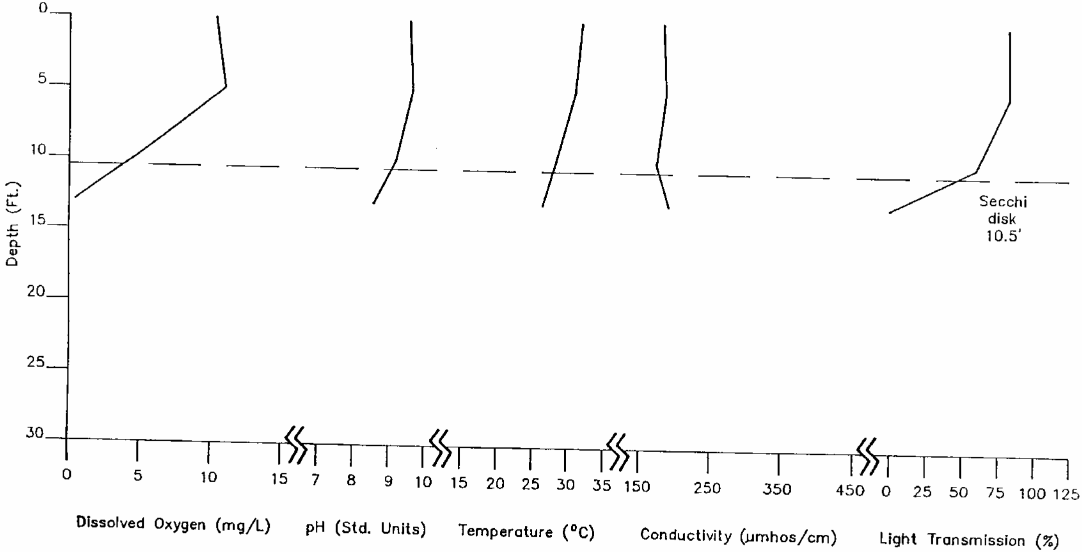
FIGURE 4.

PRIDE CREEK LAKE
SITE PC4
August 3, 1988



phosphorus) were determined from a column composite sample. The nitrate concentration was 0.10 mg/L and the dissolved phosphorus concentration was <0.01 mg/L.

All of the Prides Creek Lake pool was relatively transparent water. Relatively low concentrations of nitrogen and phosphorus were found at each station. These properties suggest that the nitrogen and phosphorus concentrations may be limiting further plant growth and eutrophication. Under these conditions, an increasing amount of limiting nutrients may accelerate the plant growth and increase eutrophication.

Eutrophication Index: Various criteria have been used for lake classification. In this report, the lake trophic state is estimated by using a composite index used by the Indiana Department of Environmental Management (IDEM). The IDEM Eutrophication Index was developed by Harold Bonhomme. Points are assigned for lake trophic parameters to give scores ranging from 0 to 75 with 75 being the most eutrophic (lowest water quality) and 0 the least eutrophic (highest quality).

The IDEM Eutrophication Index was computed for Prides Creek Lake from the field and laboratory data collected at Site PC2 on August 3, 1988. Table 4 summarizes eutrophy point calculations for each of ten diagnostic parameters.

The results indicated a eutrophication index number of 34. Based on the broad classification division of the Index (shown in Table 5), Prides Creek Lake can be classified as Class II, an intermediate level eutrophic lake with intermediate water

TABLE 4
CALCULATION OF THE IDEM LAKE EUTROPHICATION INDEX
PRIDES CREEK LAKE

PARAMETER AND RANGE		EUTROPHY POINTS
I.	Total Phosphorus (ppm)	
	0.06 to 0.19	3
II.	Soluble Phosphorus (ppm)	
	<0.01	0
III.	Organic Nitrogen (ppm)	
	0.6 to 0.8	2
IV.	Nitrate (ppm)	
	<0.05	0
V.	Ammonia (ppm)	
	At least 0.3	1
VI.	Dissolved Oxygen Percent Saturation at 5 feet from surface	
	130% to 149%	3
VII.	Dissolved Oxygen Percent of measured water column with at least 0.1 ppm dissolved oxygen	
	76% to 100%	0
VIII.	Light Penetration Secchi Disk	
	Five feet or under	0
IX.	Light Transmission Photocell Percent of light transmission at a depth of 3 feet	
	71% and up	0
X.	Total Plankton per mL: <u>One vertical tow from a depth of 5 feet</u>	
	6,000 to 10,000/mL	5
	Blue-green dominance	5 additional points
	<u>One vertical tow from a depth of 5 feet that includes the beginning of the thermocline</u>	
	30,000 or more	10
	Blue-green dominance	5 additional points
	TOTAL	34

TABLE 5

CLASSES OF LAKES BY TROPHIC STATUS
IDEM LAKE EUTROPHICATION INDEX
PRIDES CREEK LAKE

CLASS	EUTROPHY POINTS	DESCRIPTION
I	0 - 25	Least eutrophic lakes, highest quality.
II	26 - 50	Intermediate level eutrophic lakes, intermediate quality.
III	51 - 75	Advanced eutrophic lakes, lowest water quality.

TABLE 6

COMMONLY EXHIBITED CLASS II CHARACTERISTICS

*Total P concentrations of 0.04 to 0.06 mg/L as a water column average.

*TKN values of 0.6 to 0.9 mg/L as a water column average.

*Dissolved oxygen values are usually at 0.0 mg/L in the deeper waters of the hypolimnion during stratification.

*Plankton blooms occur frequently during hot weather but these are not commonly of nuisance proportions. Blue-green species are commonly dominant, but often alternate with diatoms.

*There are usually extensive, but non-problem, macrophyte concentrations in bays and littoral areas. Man-made channels and boat lanes usually have some degree of problems with the overproduction of macrophytes and/or algae.

*Solar light values at a depth of three feet usually range from 30 to 50 percent of surface value.

quality. A further description of characteristics commonly exhibited in Class II lakes is shown in Table 6. These common Class II characteristics closely describe the properties evidenced during our studies at Prides Creek Lake.

The Indiana Lake Classification System and Management Plan published by the Indiana Department of Environmental Management (1986) reported IDEM Eutrophication Index numbers for several lakes throughout the State. Prides Creek Lake was one of those surveyed in or about 1975. This report listed an Index number of 33, which compares very closely to our computed value of 34. Assuming the data used to compute these indices are accurate and representative, this comparison suggests that there has been very little change in the eutrophic state of the Lake.

Point vs. Non-Point Source Nutrient Loading: To evaluate the point vs. non-point source loading, storm event samples were collected from six Prides Creek Lake inlet stations. Typically, non-point nutrient loading only occurs during a storm event which produces watershed runoff. In watersheds where significant amounts of agricultural activity occurs, non-point nutrient sources can be very significant. The use of fertilizers high in the nutrients nitrogen and phosphorus are easily transported by the storm event runoff into water impoundments. In the Prides Creek watershed, a significant amount of the drainage area has a land use of cropland and grassland. Runoff from these areas is of particular concern.

The results from the storm event sampling at the Prides Creek inlets indicated this phenomenon. The samples showed significant amounts of nitrogen and phosphorus entering the lake. Selected samples representing peak total suspended solids (TSS) loading periods from the storm hydrograph were tested. The range of results are presented in Table 7. (Site and sample specific laboratory analyses are presented in the Appendix.)

High concentrations of nitrate and phosphorus were found at each storm runoff site as indicated in Table 7. These values are very different from the pool nutrient levels discussed earlier in this report. It is suspected that when these higher concentrations of limiting nutrients enter the lake, algal blooms have occurred. The severity of these blooms was also dependent upon conditions such as temperature and residence time in the pool.

The point source loading was evaluated during low flow conditions. During low flow conditions, non-point source nutrients from storm events do not enter the lake. By analyzing the nutrient content of inflow during low flow conditions, an evaluation of point source contributions can be made. The sources of point source contributions can include household septic treatment systems, wastewater treatment plants, feed lots, etc.

The low flow analysis made at Prides Creek indicated that these contributions were minimal. During low flow conditions, tributaries with upstream residential areas were field checked

TABLE 7
RESULTS FROM STORM EVENT ANALYSIS
PRIDES CREEK LAKE

PARAMETER	RANGE
pH (Std. Units)	7.0 - 7.5
Dissolved Oxygen (mg/L)	7.0 - 7.9
Conductivity (mhos/cm)	107 - 210
TSS (mg/L)	92 - 988
Ammonia-Nitrogen (mg/L as N)	0.05 - 0.46
TKN (mg/L as N)	1.28 - 10.2
Nitrate (mg/L as N)	2.38 - 7.91
Phosphorus (mg/L as P)	0.49 - 1.71
Dissolved Phosphorus (mg/L)	0.13 - 0.56

for point source contributions. None of the tributaries were observed to flow during low flow.

Our conclusion from field observations was that nutrient loading to the lake via point source contributions was insignificant; therefore, most nutrients entering the lake are attributed to non-point sources. The low concentrations of nutrients found in the lake pool are attributed to a season of uncharacteristically low rainfall. The pool's long retention time has allowed the existing aquatic vegetation to deplete the pool of nutrients. We are confident that if the pool sampling had occurred after a season of significant rainfall events, the nutrient concentrations would have been higher. This conclusion is consistent with our experience in surveying typical small watersheds such as Prides Creek Lake.

Watershed and Sedimentation Data

Mapping, Sediment Volume, and Nutrient Content: An analysis of the Prides Creek Lake watershed was made using

U.S.G.S. topographic mapping and aerial photography. The photography was field checked and the topographic map was analyzed according to land uses, soil units, and subwatershed acreage.

An analysis of the soil units was made by primarily reviewing those soils designated as highly erodible land (HEL). A soils map taken from the Soil Survey of Pike County, Indiana, U.S.D.A., S.C.S., is included in the Appendix. An HEL map which defines those soils within the Prides Creek watershed is also included in the Appendix. This information was obtained from Mr. Rick Noble, District Conservationist, Pike County, Indiana.

In Table 8, a summary of the watershed land use analysis is presented. Blueline copies of the photography and topographic map are included in the Appendix. The subwatershed divisions referred to in Table 8 are shown on the topographic map.

The analysis shows 51% of the Prides Creek Lake watershed was grassland. Cropland, forest, and residential land uses made up 22%, 19%, and 7%, respectively. The lake and other small impoundments made up 1%.

A further analysis of these land uses as they relate to each influent monitoring point has been examined. The seven influent points (PCR1-7) combine to make up 89% of all runoff entering the lake (Figure 1). The analysis shows that grassland again is the largest single land use, comprising 46% of the Prides Creek Lake watershed. Cropland and forest

TABLE 8

WATERSHED LAND USE ANALYSIS
PRIDES CREEK LAKE
AUGUST 1988

WATERSHED SECTION	FOREST	CROPLAND	GRASSLAND	RESIDENTIAL	WATER IMPOUND.	TOTAL
1	8.17	49.76	46.17	3.70	2.64	110.44
2	--	2.41	9.79	1.31	--	13.51
3	--	1.27	10.68	0.95	0.13	13.03
4	--	--	1.04	--	0.28	1.32
5	19.11	16.69	12.72	2.40	--	50.92
6	0.96	--	5.78	0.30	--	7.04
7	37.79	21.25	24.91	3.69	--	87.64
8	3.60	0.55	26.81	3.88	--	34.84
9	4.88	--	16.25	2.75	0.96	24.84
10	0.47	--	2.86	2.83	--	6.16
11	--	--	1.71	1.21	--	2.92
12	0.94	--	3.71	1.19	--	5.84
13	--	--	13.47	1.65	--	15.12
14	2.60	--	1.01	0.07	--	3.68
15	0.27	--	1.81	0.16	--	2.24
16	--	--	4.63	0.13	--	4.76
17	--	--	0.60	--	--	0.60
18	0.78	--	3.99	2.75	--	7.52
19	--	--	8.96	--	--	8.96
20	0.70	--	3.91	0.23	--	4.84
21	--	--	9.24	--	--	9.24
TOTAL	80.27	91.93	210.05	29.20	4.01	415.46
%	19	22	51	7	1	100

accounted for the next two largest percentages of land use; 25% and 21%, respectively. Residential areas and water impoundments account for 8% of the total. Table 9 summarizes the influent watershed analysis.

Ninety-three (93%) of the soils within the total Prides Creek watershed could be classified as highly erodible land (HEL). The HEL areas comprised 92% of the watersheds monitored at the seven influent stations. Table 9 lists the breakdown per watershed.

Using SCS methodology, the weighted curve number (CN) for the entire watershed was computed to be 78. Curve numbers are used to classify soil and cover in the watershed. A CN of 100 indicates very little cover and high runoff rates; a CN of 25 would indicate good cover and low runoff rates. A CN of 78 is a mid-range value.

Lake Sediment: During the August 3, 1988 site visit, the larger inlets into the lake were sounded to make a profile and contour map of each inlet. These maps were then compared to the topographic mapping made before the lake was impounded. Table 10 summarizes the amount of sediment volume found in these inlets.

TABLE 9
HEL WATERSHED ANALYSIS
PRIDES CREEK LAKE
AUGUST 1988

WATERSHED SECTION	FOREST	CROPLAND	GRASSLAND	RESIDENTIAL	WATER IMPOUND.	TOTAL
PCR1	6.29	--	38.00	9.63	0.96	54.88
PCR2	6.20	0.55	27.82	3.95	--	38.52
PCR3	37.79	21.25	24.91	3.69	--	87.64
PCR4	19.11	16.69	12.72	2.40	--	50.92
PCR5	8.17	9.76	46.17	3.70	2.64	110.44
PCR6	--	2.41	9.79	1.31	--	13.51
PCR7	--	1.27	10.68	0.95	0.13	13.03
	77.56	91.93	170.09	25.63	3.73	368.94
	21.02%	24.92%	46.10%	6.95%	1.01%	

89% of runoff in these watersheds.

HIGHLY ERODIBLE LAND (HEL)

WATERSHED SECTION	NON-HEL (ACRES)	TOTAL WATERSHED (ACRES)	PERCENT OF NON-HEL
PCR1	3.9	54.88	7.11%
PCR2	0.0	38.52	0.00%
PCR3	9.13	87.64	10.42%
PCR4	3.6	50.92	7.07%
PCR5	0.0	110.44	0.00%
PCR6	4.8	13.51	35.53%
PCR7	8.6	13.03	66.00%
	30.03	368.94	8.14%
TOTAL WATERSHED:	30.03	415.46	7.23%

TABLE 10

SUMMARY OF INLET SEDIMENT VOLUMES

PRIDES CREEK LAKE

AUGUST 3, 1988

WATERSHED	SEDIMENT VOLUME (CU.YDS.)	HIGHLY ERODIBLE LAND (%)
PCR1	2,181	93
PCR2	2,941	100
PCR3	11,039	90
PCR4	21,081	93
PCR5	7,794	100
PCR6	3,793	64
PCR7	500	34

These watershed identifications are shown in Figure 1 as PCR1-7. The greatest amount of sediment occurred in Watersheds 3, 4, and 5. These inlets have formed sediment deltas in the lake and have made boating in these areas very difficult. The deltas extend up to 100 feet out into the lake and form shallow areas 1-3 feet deep. Most of the sediment coming into the lake appears to be transported from the cropland usage upstream of the lake. Very little of the sediment comes from within the Park's boundaries.

Table 9 shows the percentage of non-HEL contained within each watershed. The comparison between the HEL acres in a given watershed to the sediment volumes evidenced in an inlet is inconclusive; the data cannot be correlated.

The sediment volumes, along with the sediment level found in the stormwater runoff, are better correlated to the land uses within each watershed.

Watershed 3 has accumulated some 11,039 C.Y. of sediment in its inlet. This watershed comprises the second largest acreage. The cropland areas are experiencing moderate to severe erosion. Numerous rills and gullies were seen as a significant problem and are the key indicators of the sediment problem.

Watershed 4 has accumulated the most sediment within an inlet at 21,081 C.Y. This watershed comprises the third largest acreage and contains 33% cropland. The cropland areas are experiencing continual severe erosional problems. This area and its associated problems have been well documented by the District Conservationist.

Watershed 5 is the largest at 110.44 acres of drainage and the third lowest in accumulated volume of sediment in an inlet. The cropland area comprises 45% of the watershed acreage. The land uses are a key to the reduced sediment loading. The cropland areas are occurring only on the ridge tops on slopes of 0-6% where erosional problems are minimal. To further reduce sediment loading, three farm ponds filter all runoff from 59% of this watershed. The lower portion of the watershed is grassland with good vegetative stand which further serves to filter runoff and to minimize the erosion potential. The culvert under the road also appears restrictive and adds sediment deposition during storm events.

__Sediment Nutrients__: On August 3, 1988, sediment core samples were collected at two sites, PCS1 and PCS2. These sites, shown in Figure 1, are located in sediment deltas in two of the lake's inlets. The collection samples were composited from columns of sediment 0-8 inches in depth. Each core was analyzed for the parameters listed in Table 2. In Table 11, the results from those determinations are presented.

TABLE 11

ANALYSIS OF SEDIMENT CORE SAMPLES
PRIDES CREEK LAKE INLETS
AUGUST 3, 1988

	P^T (mg/Kg)	P^D (mg/Kg)	TKN (mg/Kg)	NO_3-N (mg/Kg)	NH_3-N (mg/Kg)
PCS1	113.4	8.0	29.5	<0.05	0.05
PCS2	134.6	8.5	29.5	<0.05	0.03

Both samples appeared to have similar analytical qualities. A significant concentration of total phosphorus was found but the dissolved phosphorus values indicate that very little may be available for plant growth. The nitrogen determinations were similar. The TKN values were high but the nitrate and ammonia were low. This means the TKN value was mainly organic nitrogen which is a form not readily available for plant growth. These results indicate the sediment did not contain very high concentrations of available plant nutrients.

__Model: Predicting Storm Event Loading__: To predict storm event sediment loading into Prides Creek Lake, the computer model SEDIMOT II was used. SEDIMOT II is a hydrologic and sedimentologic model developed by Richard Warner and others at the University of Kentucky. The model predicts a storm hydrograph for a given storm of a specific watershed and predicts the quantity of sediment eroded and routed to a discharge point.

To calibrate the model to the conditions existing at Prides Creek Lake, discharge and sediment characteristics measured on-site during a rainfall event of 1.3 in./12 hrs. were used. By using on-site storm data, the model was set to predict conditions at Prides Creek with greater accuracy than by using textbook data for calibration. The land use and mapping characteristics described in the previous sections were also used. In Table 12, the predictions of SEDIMOT II are presented for five subwatersheds for a 4.6-inch, 10-year, 24-hour and a 1.3-inch, 12-hour storm event.

The model predicted that 73.3 tons of sediment would be deposited into the lake during a 10-year, 24-hour storm event. With designed silt control structures in each of the major inlets, most of the sediment load entering the lake could be eliminated.

Aquatic Weed Survey

On August 3, 1988, an aquatic weed survey was made of the lake. Emergent plants along the shoreline, as well as submergent plants, were identified. The summary presented in Table 13 lists the predominant aquatic weeds found.

TABLE 12

SUMMARY OF SEDIMOT II MODELING RESULTS
PRIDES CREEK LAKE

			4.6 IN/24 HR (MODEL)			1.3 IN/12 HR (MODEL)			1.3 IN/12 HR (ACTUAL)*	
WATERSHED	ACRES	CN	PEAK Q (CFS)	TSS_p (mg/L)	LOAD (Tons)	Q	PEAK TSS	LOAD	Q	TSS
SEC 1	110.44	79	212.0	883	16.9	10.7	566	0.75	9.0	988
SEC 5	50.92	74	68.5	3065	20.2	1.5	2950	1.08		
SEC 7	87.64	73	75.4	1790	20.9	1.6	2350	1.36		
SEC 8	34.84	76	39.6	1740	8.83	1.4	1700	0.57		
SEC 9	24.84	76	35.5	1860	6.44	1.3	1860	0.41		
TOTALS	308.68				73.3			4.17		

* Only storm water data collected in Watershed SEC1 was used to calibrate the SEDIMOT II model. This watershed was selected because it was the largest subwatershed; therefore, subject to less variability than the smaller watersheds.

TABLE 13

AQUATIC WEED SUMMARY
PRIDES CREEK LAKE
AUGUST 3, 1988

TYPE	COMMON NAME	SCIENTIFIC NAME	DEPTH FOUND (ft.)	PERCENT COVER[1]
Submergent	American pondweed	*Potomogeton nodosus*	0-8	10
	Sago pondweed	*Potomogeton pectinatus*	0-8	5
	Slender pondweed	*Najas flexilis*	0-8	<5
Emergent	Cattail	*Typha* sp.	0-1	20
	Willow	*Salix* sp.	0-1	<5
	Creeping water primrose	*Jussiaea decurrens*	0-1	10
	Arrowhead	*Sagittaria* sp.	0-1	<5
	Spikerush	*Eleocharis* sp.	0-1	5

[1] Coverage refers to surface area where plants can be found for submergent plants and shoreline length for emergent plants may be found.

Most of these aquatic weeds were located in a 10 to 20-foot band around the lake shoreline. Some of the weeds, especially the cattails, creeping water primroses, and American pondweed, are a nuisance to fishermen and boaters.

A photographic documentation is provided in the Appendix. These photographs show the extent of the aquatic weed growth as well as identifies areas where there are no significant weed crops present.

The results of the survey identified typical aquatic weeds common in most lakes in this region. Their location around the lake seemed to be mainly associated within shallow areas where siltation has occurred. Some weed growth was observed in water depths up to eight feet. This was possible because of the relatively good transparency of the lake.

A review of aquatic weed survey data from a 1984 Fish Management Report by Michael V. Thomas, Division of Fish and Wildlife, showed similar results. Cattail and creeping water primrose were identified in 1984 as nuisance aquatic plants in amounts similar to those reported here.

Physical and chemical weed control efforts have been used at Prides Creek Lake for several years. Mr. David Barrett, who manages the weed control program at Prides Creek Lake Park, reports a winter drawdown of the lake pool was used this last winter season (1987-88). This allowed maintenance crews to clear areas where aquatic weeds had been a problem.

Chemical treatments have also been applied. Late May of each of the past few years the herbicide "Aquathol K" has been applied. "Rodeo", another herbicide, has also been used. The Park spends approximately $1200/year in chemical costs for aquatic vegetation control.

The results of these treatments are mixed. The drawdown of the lake is helpful to clean up troublesome areas where weed growth occurred the previous year; however, it seems to have little effect on discouraging weed growth the next season.

Cattail control with "Rodeo" has been somewhat successful. This herbicide is effective in controlling these weeds. The drawback to this treatment is the expense. Rodeo costs approximately $140/gallon.

Aquathol K has been appplied throughout the lake. It is applied in May because that is when the weeds are actively growing. Mr. Barrett indicates that treatments have shown very little effectiveness. He said the overall control of the aquatic weed vegetation has been a losing battle.

In terms of algae, two algal tows were conducted at the deepest lake site, PC2: a 5-foot to surface tow and a tow 5 feet through the beginning of the thermocline. In Table 14, the identification of the predominant species is presented. Both tows contained similar algae distribution with the blue-green algae Anabaena sp. being the dominant species.

TABLE 14

SUMMARY OF ALGAE IDENTIFICATION
PRIDES CREEK LAKE

TOW	ALGAE ID (IN ORDER OF PREDOMINANCE)
0 - 5	Anabaena sp.
	Eudorina elegans
	Pandorina morurn
5 - Thermocline	Anabaena sp.
	Eudorina elegans
	Pandorina morurn

IDENTIFICATION OF PROBLEMS

A broad base of data is important in identifying problem areas in a given watershed. In this study, the collected water quality, sedimentation, and aquatic weed data was used to characterize the Prides Creek Lake watershed. An accurate assessment of these characteristics is essential to make good management decisions.

The water quality data indicated good quality. The lake phosphorus and nitrogen concentrations were low, apparently limiting algae proliferation. The lake transparency was very good and no significant point source nutrient contributions were identified. Non-point contributions from watershed runoff were the major source of dissolved and suspended nutrients to the lake.

The sediment loading to the lake was one of the major problems endangering the lake. Deltas of silt in several inlets are reducing the lake volume, promoting weed growth, and reducing navigatable areas on the lake. Current land management practices leave portions of the watershed unprotected to the forces of erosion. Tons of sediment are settling into Prides Creek Lake along with nutrients which accelerate eutrophication and excessive weed growth.

Aquatic weeds were found around the lake shoreline and in the lake inlets where silt build-up had occurred. These shallow areas encourage plant proliferation. Control of these areas is essential to the overall management plan of the lake.

DISCUSSION OF ALTERNATIVE SOLUTIONS AND EXPECTED RESULTS

As identified in the previous sections, control of storm runoff (sediment and nutrients) and control of aquatic vegetation are the major concerns facing the Prides Creek Lake management. In this section, several alternative solutions are presented to deal with these problems and to enhance the use of the lake. These alternatives are presented in order of cost. Along with each alternative, the expected results of each are discussed.

Alternative No. 1 - Do Nothing; Maintain Existing Program

By selecting this alternative, no efforts would be made to control sediment but the physical and chemical methods currently being used to control aquatic vegetation would continue. The most important physical method, which has been used one time, is the winter drawdown technique. This exposes the sediment in shallow areas to alternating freezing and thawing action. This action is effective in killing underground aquatic weed rhizomes. In addition to weed control, drawdown allows sediment to dry and compact, thereby increasing the depth of shallow areas. Drawdown also concentrates the fish which increases the predation of the smaller fish by the larger ones. Fishing quality often improves after a drawdown. Drawdown is a very inexpensive method of weed control and should be continued each year.

The chemical control methods would include a spring application of Aquathol K and spot summer applications of Rodeo. Aquathol K is an aquatic herbicide which is effective against a wide variety of aquatic weeds (many of which were identified in the aquatic weed survey). Rodeo is also an aquatic herbicide. It is especially effective in controlling cattail in late summer. Total cost of these chemicals has been approximately $1200/year.

As mentioned earlier, this alternative does not address the sediment problem. Without sediment control, siltation of the lake will continue to bring more sediment and nutrients. More shallow areas will form and boat navigation in the lake will be reduced further. Eutrophication is expected to continue at a relatively slow pace with this alternative.

Alternative No. 2 - Construct Inlet Sediment Control Structures; Maintain Aquatic Weed Control Program; Land Treatment

This alternative would intensify the physical and chemical methods of weed control described in Alternative No. 1 and add at least two inlet sediment control structures. These sediment control structures could be built using several designs. The goal of these structures would be to stop sediment from reaching the lake pool. During storm events, these structures would intercept the runoff. They would be designed to provide for storm water detention, allowing the sediment to settle. Along with the settlement of suspended solids, a reduction of the nutrient loading to the lake is expected to occur. Some of the nutrients associated with plant growth would settle in the structure along with the suspended solids.

The two watersheds with the significant sediment loading problems are the areas in which structures should be constructed.

In Watershed 3, an area identified on the aerial photograph has been selected as the prime location for various reasons. This area was once suitable for public access, boating, and camping. Through time, however, this area has acted like a sediment structure. This area is now full of sediment. To better serve the protection of the lake from further sedimentation, this area should be made into a structure by the removal of the sediment to a depth that will provide the best retention and sediment storage. This will also serve to enhance the adjacent public activities and once again bank fishing, boating, and camping would be available to this area. This structure also presents an ease in access for maintaining the structure should the sediment level ever again present a problem. Last within this problem watershed, this is the only choice for such a structure. The surrounding area is camp sites, and above that; the topography does not lend itself well for the construction of such a structure.

Watershed 4 also has some of the same problems as Watershed 3. The topography within the park boundaries from lake line to fence line does not lend itself to the construction of a structure. Our recommendation is that the inlet be cleaned out to a size suitable for retention and sediment level. The dipped-out sediment would be used to construct a small dam across the inlet. An emergency spillway would be the current sediment level in that area so that the water level in this area would remain with the lake level. Another problem associated with this waterhed is the head cutting occurring in the main drainage channel into the lake. It is also our recommendation that this channel be graded with smooth side slopes. A filter fabric with riprap or an excelsior type blanket and wet grasses could be utilized. Either of these methods is dependent upon channel velocity and can be better determined during the design phase.

The specific location for these two structures is shown on the aerial photograph found in the Appendix.

The major concern of this alternative is the cost of construction. Each structure, depending on its design, could cost several thousand dollars.

A new Indiana Department of Natural Resources (IDNR) program, known as "T by 2000", is administered by the Division of Soil Conservation program. This program may be able to provide cost share financial assistance for the implementation of sediment control measures with the Prides Creek Lake conservancy and to adjacent landowners for construction of water sediment control basin (WASCOB).

The landowners within Watersheds 3 and 4 have been contacted regarding the "T by 2000" Cost-Share Program. The aerial photograph shows the location of proposed WASCOB's and a terrace. The construction of these basins will probably be the greatest enhancement in sediment load reduction to the lake. These basins are in several phases from being proposed to having been surveyed and designed for hopeful construction in the spring of 1989. This work is being performed by the Divisions' Soil Conservation office in Petersburg, Indiana.

One of the landowners in Watershed 4, which has the severe erosional cropland problem, is also being talked to in regards to signing this acreage into the Conservation Reserve Program (CRP). This would allow the land to be planted with wildlife vegetation, grasses, and legumes for a period of 10 years which would aid in reducing the erosion tendency of this land.

These two programs, if implemented as desired, would enhance the protection of Prides Creek Lake and restore and retain the sediment within the respective land areas.

Alternative No. 3 - Construct Inlet Sediment Control Structures; Dredge Sediment from Lake Inlets; Maintain Aquatic Weed Control Program

This alternative is similar to Alternative No. 2 except dredging of the lake inlets is proposed. The sediment would be collected in the structures, the aquatic weeds would be controlled with the physical and chemical methods, and the sediment deltas in the lake would be dredged out and disposed.

As indicated in Table 9, several thousand cubic yards of sediment exist in the lake inlets, especially in Watersheds 3, 4, and 5. Equipment is available to dredge the sediment from the lake and transport it to a disposal site. Dredging the inlets would make more of the lake accessible to boaters. Dredging is the only alternative that would open up some portions of the lake.

The drawback to this alternative is the cost. The equipment needed to dredge the lake is expensive. There is also the problem with what to do with the sediment. The topography and available acreage for disposal is limited. An off-site disposal site would be needed for sediment disposal.

PREFERRED ALTERNATIVE

Based on the preliminary information reviewed in this report, Alternative No. 2 appears to be the best choice. The cost versus benefit makes this alternative attractive. The sediment control structures would reduce further siltation in the inlets. The aquatic weed management program will continue to control the weeds. After the sediment control structures are in place and several seasons of winter drawdown have occurred, a noticeable reduction of the aquatic weed problem would be expected. Of course, the IDNR interest in providing financial support for sediment control structures in the "T by 2000" Lake Enhancement Program is important to this alternative. The capital cost of this alternative is estimated at $150,000 with an annual maintenance cost of $3,000. The capital cost includes: dredging, dewatering, loading, placement, and stabilization of sediment. It also includes the engineering design fees and full time inspection of construction. The annual cost estimate includes chemical cost of herbicides needed to control the aquatic vegetation.

APPENDIX

FIELD DATA SHEETS

AQUATIC WEED SURVEY - PHOTOGRAPHIC DOCUMENTATION

STORM EVENT LABORATORY ANALYSES

WATERSHED AND SEDIMENTATION MAPPING

FIELD DATA SHEETS

WATER QUALITY FIELD DATA

LOCATION Prides Creek Lake Near Dam No. 2 BY MT JB SY

WEATHER Mostly Clear

WIND VELOCITY <5 MPH AIR TEMPERATURE 98

COLOR CURRENT SPEED Static BAROMETER

REMARKS Sampled just after Rain

STATION (1-9)	DATE (10-15)	TIME (16-19)
Pride 2	880803	1630

DUPLICATE COLUMNS 1-19 ON ALL CARDS

(Zero-fill columns 1-22)

DEP. (20-22)	TEMP. (23-26)	D.O. (27-30)	COND. (31-34)	PH (35-38)	ORP (39-42)	TOT. ALK. (43-45)	PHTH. ALK. (46-48)	MAX. DEP. (49-51)	DIST. BET. BANKS (52-55)	DIST. FROM L.BANK (56-59)	SECCHI DISK (60-63)	WATER SURFACE ELEVATION (64-69)	INST. DISCHARGE (70-75)	% Trans (76-80)
000	32.6	10.4	185	9.6				27			10.8			85.5
005	30.5	10.6	185	9.6										87.0
010	28.8	13.6	188	9.6										23.0
015	26.6	10.5	194	7.6										10
020	20.5	10.5	254	7.2										20
025	15.5	10.6	372	7.2										4.5
27.2														0.2
1 21.5	27.3	8.8	184	9.1										5.0

ORN Form 561

ORNED·E

WATER QUALITY FIELD DATA

LOCATION: Prides Creek No 3 Mid-lake BY: EMT JB SY

WEATHER: Sunny

WIND VELOCITY: <5MPH AIR TEMPERATURE: 95

COLOR: CURRENT SPEED: Static BAROMETER:

REMARKS:

STATION (1-9)	DATE (10-15)	TIME (16-19)	DUPLICATE COLUMNS 1-19 ON ALL CARDS
Pride 3	880803	1630	

(Zero-fill columns 1-22)

	DEP. (20-22)	TEMP. (23-26)	D.O. (27-30)	COND. (31-34)	PH (35-38)	ORP (39-42)	TOT. ALK. (43-45)	PHTH. ALK. (46-48)	MAX. DEP. (49-51)	DIST. BET. BANKS (52-55)	DIST. FROM L.BANK (56-59)	SECCHI DISK (60-63)	WATER SURFACE ELEVATION (64-69)	INST. DISCHARGE (70-75)	% T (76-80)
	000	32.4	9.7	183	9.6				21			10.6			86
	005	30.9	10.3	184	9.6										85
	010	28.8	11.8	186	9.6										61
	015	26.0	9.5	196	7.8										20
	019	22.6	10.5	228	7.4										24
1	21.5	28.2	13.8	189	9.6										30

WATER QUALITY FIELD DATA

LOCATION Prides Creek No. 4 BY EMT JB SY

WEATHER Sunny

WIND VELOCITY 5MPH AIR TEMPERATURE 90

COLOR CURRENT SPEED static BAROMETER

REMARKS

STATION	DATE	TIME
Pride 4	880803	1845

DUPLICATE COLUMNS 1-19 ON ALL CARDS

(Zero-fill columns 1-22)

	DEP.	TEMP.	D.O.	COND.	PH	ORP	TOT. ALK.	PHTH. ALK.	MAX. DEP.	DIST. BET. BANKS	DIST. FROM L.BANK	SECCHI DISK	WATER SURFACE ELEVATION	INST. DISCHARGE	% / (
	0010	32.2	10.5	187	9.6				15			10.5			83
	0105	31.2	11.2	190	9.7										83
	0110	28.5	4.6	177	9.2										60
	0113	26.7	9.5	193	8.6										9.5
7	.5														56

ORN Form 561

ORNED E

AQUATIC WEEDS SURVEY - PHOTOGRAPHIC DOCUMENTATION

INDEX OF PHOTOGRAPHS
PRIDES CREEK LAKE

PLATE	PHOTO #	DESCRIPTION
1	1	Pool side of road culvert.
	2	Inlet side of road culvert.
	3	Typical, showing submergent and emergent plants.
	4	Cattails.
2	1	Dense aquatic weed growth near inlet.
	2	Cattails restricting shore use.
	3	Cattails and others restricting shore use.
	4	Cattails and others restricting shore use.
3	1	Designated swimming area.
	2	Designated swimming area.
	3	Shoreline relatively free of cattails.
	4	Shoreline relatively free of cattails.
4	1	Shoreline relatively free of emergent weeds.
	2	Shoreline relatively free of emergent weeds.
	3	Typical, of lake.
	4	Shoreline relatively free of emergent weeds.













STORM EVENT LABORATORY ANALYSES

COMMONWEALTH TECHNOLOGY, INC.
2520 Regency Road, Suite 104
Lexington, Kentucky 40503
606-276-3506

EDWARD G. FOREE, Ph.D., P.E.

JOHN S. TAPP, Ph.D., P.E.

Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8011

CTI LAB NO: W8806284

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 1 -10:00 A.M.

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.5
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.9
Conductivity (micromhos/cm)	170
Total Suspended Solids (mg/L)	168
Ammonia-Nitrogen (mg/L as N)	0.08
Total Kjeldahl Nitrogen (mg/L as N)	2.05
Nitrate (mg/L)	3.18
Phosphorus	0.55
Phosphorus, Dissolved (mg/L)	0.30

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Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8012

CTI LAB NO: W8806285

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 2 -10:30 A.M.

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.2
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.6
Conductivity (micromhos/cm)	107
Total Suspended Solids (mg/L)	444
Ammonia-Nitrogen (mg/L as N)	0.10
Total Kjeldahl Nitrogen (mg/L as N)	2.30
Nitrate (mg/L)	2.38
Phosphorus	0.55
Phosphorus, Dissolved (mg/L)	0.13

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Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8013

CTI LAB NO: W8806286

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 3 -10:30 A.M.

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.2
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.0
Conductivity (micromhos/cm)	144
Total Suspended Solids (mg/L)	488
Ammonia-Nitrogen (mg/L as N)	0.31
Total Kjeldahl Nitrogen (mg/L as N)	2.50
Nitrate (mg/L)	3.54
Phosphorus	0.77
Phosphorus, Dissolved (mg/L)	0.31

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Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8014

CTI LAB NO: W8806287

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 5 - 3:35 (PRC SEC 1)

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.3
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.9
Conductivity (micromhos/cm)	210
Total Suspended Solids (mg/L)	988
Ammonia-Nitrogen (mg/L as N)	0.05
Total Kjeldahl Nitrogen (mg/L as N)	10.2
Nitrate (mg/L)	7.91
Phosphorus	1.71
Phosphorus, Dissolved (mg/L)	0.51

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DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8015

CTI LAB NO: W8806288

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 6-11:20 A.M.

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.2
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.8
Conductivity (micromhos/cm)	193
Total Suspended Solids (mg/L)	92
Ammonia-Nitrogen (mg/L as N)	0.09
Total Kjeldahl Nitrogen (mg/L as N)	1.28
Nitrate (mg/L)	4.62
Phosphorus	0.49
Phosphorus, Dissolved (mg/L)	0.35

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Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*Amended: December 1, 1988

CTI REPORT NO: DO 8016

CTI LAB NO: W8806289

PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

SOURCE OF SAMPLE: Donan/Prides Creek No. 7- 3:23

DATE OF COLLECTION: *7/20-21/88

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.0
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.6
Conductivity (micromhos/cm)	208
Total Suspended Solids (mg/L)	972
Ammonia-Nitrogen (mg/L as N)	0.46
Total Kjeldahl Nitrogen (mg/L as N)	7.00
Nitrate (mg/L)	7.13
Phosphorus	1.48
Phosphorus, Dissolved (mg/L)	0.56

WATERSHED AND SEDIMENTATION MAPPING

DONAN ENGINEERING CO., INC.

JOHN G. DONAN, JR., P. E., PRESIDENT

R. R. 3, BOX 40H · U. S. HWY. 231 NORTH
JASPER, INDIANA 47546
TEL. (812) 482-5611

January 12, 1990

Mr. Paul Glander
Division of Soil Conservation
FLX 1 Purdue University
West Lafayette, IN 47907

Re: Prides Creek Lake
Feasibility Study

Dear Paul:

During the analysis of storm runoff data for a different lake feasibility study, it became apparent that the lab analysis sheets for two similar lake studies had been switched at the water quality laboratory. To correct the circumstance, we are issuing an Addendum to the Prides Creek Feasibility Study, revising the associated pages and tables.

We sincerely apologize for the error and the inconvenience. Fortunately, the circumstance does not affect the results of the feasibility study, nor the on-going design study.

Should you have any concerns or questions regarding the addendum, please feel free to contact our office.

Best regards,

DONAN ENGINEERING CO., INC.

Karen S. Dearlove

Karen S. Dearlove
Manager, Environmental Studies

Enclosure

KSD/ljl

ADDENDUM
TO THE

FEASIBILITY STUDY
FOR THE
LAKE ENHANCEMENT PROGRAM
OF
PRIDES CREEK LAKE
NEAR
PETERSBURG, INDIANA

Prepared for:

PRIDES CREEK CONSERVANCY DISTRICT
715 S. 9th Street
Petersburg, Indiana 47567

and

INDIANA DEPARTMENT OF NATURAL RESOURCES
Division of Soil Conservation
FLXI, Purdue University
West Lafayette, Indiana 47907

Prepared by:

DONAN ENGINEERING CO., INC.
R.R. 3, Box 40H
Jasper, Indiana 47546

JANUARY 2, 1990

U.S.G.S. topographic mapping and aerial photography. The photography was field checked and the topographic map was analyzed according to land uses, soil units, and subwatershed acreage.

An analysis of the soil units was made by primarily reviewing those soils designated as highly erodible land (HEL). A soils map taken from the Soil Survey of Pike County, Indiana, U.S.D.A., S.C.S., is included in the Appendix. An HEL map which defines those soils within the Prides Creek watershed is also included in the Appendix. This information was obtained from Mr. Rick Noble, District Conservationist, Pike County, Indiana.

In Table 8, a summary of the watershed land use analysis is presented. Blueline copies of the photography and topographic map are included in the Appendix. The subwatershed divisions referred to in Table 8 are shown on the topographic map.

The analysis shows 51% of the Prides Creek Lake watershed was grassland. Cropland, forest, and residential land uses made up 22%, 19%, and 7%, respectively. The lake and other small impoundments made up 1%.

A further analysis of these land uses as they relate to each influent monitoring point has been examined. The seven influent points (PCR1-7) combine to make up 81% of all runoff entering the lake (Figure 1). The analysis shows that grassland again is the largest single land use, comprising 35% of the Prides Creek Lake watershed. Cropland and forest accounted for the next two largest percentages of land use; 22% and 18%, respectively. Residential areas and water impoundments account for 6% of the total. Table 9 summarizes the influent watershed analysis.

Ninety-three (93%) of the soils within the total Prides Creek watershed could be classified as highly erodible land (HEL). The HEL areas comprised 80% of the watersheds monitored at the seven influent stations. Table 9 lists the breakdown per watershed.

Using SCS methodology, the weighted curve number (CN) for the entire watershed was computed to be 78. Curve numbers are used to classify soil and cover in the watershed. A CN of 100 indicates very little cover and high runoff rates; a CN of 25 would indicate good cover and low runoff rates. A CN of 78 is a mid-range value.

Lake Sediment: During the August 3, 1988 site visit, the larger inlets into the lake were sounded to make a profile and contour map of each inlet. These maps were then compared to the topographic mapping made before the lake was impounded. Table 10 summarizes the amount of sediment volume found in these inlets.

TABLE 9
HEL WATERSHED ANALYSIS
PRIDES CREEK LAKE
AUGUST 1988

WATERSHED SECTION	FOREST	CROPLAND	GRASSLAND	RESIDENTIAL	WATER IMPOUND.	TOTAL
PCR1	4.88	--	16.25	2.75	0.96	24.84
PCR2	3.60	0.55	26.81	3.88	--	34.84
PCR3	37.79	21.25	24.91	3.69	--	87.64
PCR4	19.11	16.69	12.72	2.40	--	50.92
PCR5	8.17	49.76	46.17	3.70	2.64	110.44
PCR6	--	2.41	9.79	1.31	--	13.51
PCR7	--	1.27	10.68	0.95	0.13	13.03
	73.55	91.93	147.33	18.68	3.73	335.22
	17.70%	22.13%	35.46%	4.50%	0.90%	80.69%

HIGHLY ERODIBLE LAND (HEL)

WATERSHED SECTION	NON-HEL (ACRES)	WATERSHED (ACRES)	PERCENT NON-HEL
PCR1	3.9	24.84	15.70%
PCR2	0.0	34.84	0.00%
PCR3	9.13	87.64	10.42%
PCR4	3.6	50.92	7.07%
PCR5	0.0	110.44	0.00%
PCR6	4.8	13.51	35.53%
PCR7	8.6	13.03	66.00%
	30.03	335.22	19.25%
TOTAL WATERSHED	30.03	415.46	7.23%

model SEDIMOT II was used. SEDIMOT II is a hydrologic and sedimentologic model developed by Richard Warner and others at the University of Kentucky. The model predicts a storm hydrograph for a given storm of a specific watershed and predicts the quantity of sediment eroded and routed to a discharge point.

To calibrate the model to the conditions existing at Prides Creek Lake, discharge and sediment characteristics for a 4.6-inch, 10-year/24-hour rainfall event were used. The land use and mapping characteristics described in the previous sections were also used. In Table 12, the predictions of SEDIMOT II are presented for five subwatersheds. The model predicted that 73.3 tons of sediment would be deposited into the lake during a 10-year, 24-hour storm event. With designed silt control structures in each of the major inlets, most of the sediment load entering the lake could be eliminated.

Aquatic Weed Survey

On August 3, 1988, an aquatic weed survey was made of the lake. Emergent plants along the shoreline, as well as submergent plants, were identified. The summary presented in Table 13 lists the predominant aquatic weeds found.

TABLE 12
SUMMARY OF SEDIMOT II MODELING RESULTS
PRIDES CREEK LAKE

WATERSHED	ACRES	CN	4.6 IN/24 HR (MODEL) PEAK Q (CFS)	TSS$_P$ (mg/L)	LOAD (Tons)
SEC 1/PCR 5	110.44	79	212.0	883	16.9
SEC 5/PCR 4	50.92	74	68.5	3065	20.2
SEC 7/PCR 3	87.64	73	75.4	1790	20.9
SEC 8/PCR 2	34.84	76	39.6	1740	8.83
SEC 9/PCR 1	24.84	76	35.5	1860	6.44
TOTALS	308.68				73.3

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Environmental and Natural Resources Consulting and Analytical Services

DATE: August 8, 1988
*AMENDED: 01/10/90

CTI REPORT NO: DO 8005

CTI LAB NO: W8806278

*PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

*SOURCE OF SAMPLE: Donan/Prides Creek Storm Event Sample PCR1

*DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	6.6
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	6.9
Conductivity (micromhos/cm)	71
Total Suspended Solids (mg/L)	156
Ammonia-Nitrogen (mg/L as N)	0.29
Total Kjeldahl Nitrogen (mg/L as N)	1.10
Nitrate (mg/L)	0.60
Phosphorus	0.83
Phosphorus, Dissolved (mg/L)	0.35

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CTI REPORT NO: DO 8006

CTI LAB NO: W8806279

*PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

*SOURCE OF SAMPLE: Donan/Prides Creek Storm Event Sample PCR2

*DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.0
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.0
Conductivity (micromhos/cm)	93
Total Suspended Solids (mg/L)	200
Ammonia-Nitrogen (mg/L as N)	0.11
Total Kjeldahl Nitrogen (mg/L as N)	1.50
Nitrate (mg/L)	0.85
Phosphorus	0.92
Phosphorus, Dissolved (mg/L)	0.24

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DATE: August 8, 1988
*AMENDED: 9/12/88
**AMENDED: 01/10/90

CTI REPORT NO: DO 8007

CTI LAB NO: W8806280

**PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

**SOURCE OF SAMPLE: Donan/Prides Creek Lake Storm Event Sample PCR3

**DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	6.9
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	6.5
Conductivity (micromhos/cm)	89
Total Suspended Solids (mg/L)	456
Ammonia-Nitrogen (mg/L as N)	0.06
Total Kjeldahl Nitrogen (mg/L as N)	0.89
Nitrate (mg/L)	0.6*
Phosphorus	0.68
Phosphorus, Dissolved (mg/L)	0.15

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DATE: August 8, 1988
*AMENDED: 01/10/90

CTI REPORT NO: DO 8008

CTI LAB NO: W8806281

*PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

*SOURCE OF SAMPLE: Donan/Prides Creek Lake Storm Event Sample PCR4

*DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	6.3
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	5.8
Conductivity (micromhos/cm)	83
Total Suspended Solids (mg/L)	1340
Ammonia-Nitrogen (mg/L as N)	0.46
Total Kjeldahl Nitrogen (mg/L as N)	2.65
Nitrate (mg/L)	4.35
Phosphorus	1.02
Phosphorus, Dissolved (mg/L)	0.09

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DATE: August 8, 1988
*AMENDED: 01/10/90

CTI REPORT NO: DO 8009

CTI LAB NO: W8806282

*PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

*SOURCE OF SAMPLE: Donan/Prides Creek Lake Storm Event PCR4A

*DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	8.0
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	8.6
Conductivity (micromhos/cm)	124
Total Suspended Solids (mg/L)	216
Ammonia-Nitrogen (mg/L as N)	0.03
Total Kjeldahl Nitrogen (mg/L as N)	0.99
Nitrate (mg/L)	0.46
Phosphorus	0.32
Phosphorus, Dissolved (mg/L)	0.17

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*AMENDED: 01/10/90

CTI REPORT NO: DO 8010

CTI LAB NO: W8806283

*PROJECT NO.: 170

TO: Jim Buckles

REPORT ON TESTING OF WATER SAMPLES

*SOURCE OF SAMPLE: Donan/Prides Creek Lake Storm Event PCR5

*DATE OF COLLECTION: 7/20/88; 1730

DATE RECEIVED: 7/22/88

SAMPLE TYPE: Grab

PARAMETER	CONCENTRATION
pH	7.5
Dissolved Oxygen (mg/L) (readings taken in lab 7/25)	7.6
Conductivity (micromhos/cm)	335
Total Suspended Solids (mg/L)	60
Ammonia-Nitrogen (mg/L as N)	0.07
Total Kjeldahl Nitrogen (mg/L as N)	1.85
Nitrate (mg/L)	1.72
Phosphorus	0.44
Phosphorus, Dissolved (mg/L)	0.26

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